No of Pages : 3   Course Code: 08P401

Roll No:
(To be filled in by the candidate)

PSG COLLEGE OF TECHNOLOGY, COIMBATORE - 641 004

SEMESTER EXAMINATIONS, JUNE - 2013

BE(SW) - PRODUCTION ENGINEERING   Semester: 4

08P401   FLUID MECHANICS AND MACHINERY

Time: 3 Hours   Maximum Marks: 100

INSTRUCTIONS:
1. Group I and Group II questions should be answered in the Main Answer Book.
2. Answer any **FIVE** questions in Group II.
3. Answer **ALL** questions in Group I and Group III.
4. Group III − **Multiple Choice questions** - (which will be given to the candidates half an hour before the scheduled close of the examination) **should be answered only** in the space provided **in the Main Answer Book.**

GROUP I   Marks: 10 x 3 = 30

1. Differentiate between a liquid and a gas.

2. Give an example each for viscous and inviscid flow.

3. State the assumptions of Bernoulli's equation.

4. State Buckingham's π theorem.

5. Define Newton's law of viscosity.

6. Define Froude and Mach number.

7. Define surface tension.

8. What is the significance of Reynold's number in frictional loss calculation in pipes?

9. Define net positive suction head.

10. What is the necessity of draft tubes in reaction turbines?

GROUP II   Marks: 5 x 12 = 60

11. A Francis turbine with an overall efficiency of 75% is required to produce 150 kW at the shaft. It is working under a head of 7.62 m. The wheel runs at 150 rpm and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine

(a) guide blade angle   (b) vane angle at inlet

(c) diameter of the wheel at the inlet   (d) width of the wheel at the

inlet. Take peripheral velocity = $0.26(2gH)^{1/2}$ and $V_{f1} = 0.96(2gH)^{1/2}$.

12. A flat plate $0.1 m^2$ area is pulled at 30 cm/s relative to another plate located at a distance of 0.01 cm from it, The fluid separating them being water with dynamic viscosity 0.001 Ns/m^2. Find the force and power required to maintain the velocity.

13. A smoking lounge is to accommodate 15 heavy smokers. The minimum fresh air requirement for smoking lounges is specified to be 30 L/s per person. Determine the minimum required flow rate of fresh air that need to be supplied to the lounge and the diameter of the duct if the air velocity is not to exceed 8 m/s.

14. A Kaplan turbine develops 24.65 MW power at an average head of 39 m. Assuming a speed ratio of two, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter and speed of the turbine.

15. Air is flowing over a smooth flat plate with a velocity of 12 m/s. The length of the plate is 1.1 m and width 0.9 m. if laminar boundary layer exists up to a value of 2×10^5 , and kinematic viscosity of air is 0.15 stokes, find

    i. the maximum distance from the leading edge upto which laminar boundary layer exists. ii. Maximum thickness of boundary layer.

16. Water at 15°C is to be discharged from a reservoir at a rate of 18 L/s using two horizontal cast iron pipes connected in series and a pump between them. The first pipe is 20 m long and has a 6 cm diameter, while the same for the second pipe are 35 m and 4 cm respectively. The pipe entrance is sharp edged and losses associated with the connection of the pump are negligible. Neglecting the kinetic energy correction factor determine the required pumping head and the minimum pumping power to maintain the indicated flow rate.

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FD/RL

> Write the Alphabet of your choice answer for each question in the space provided in the Main Answer Book
> (Do not attach this question paper along with the Main Answer Book)

JUNE – 2013

08P401   FLUID MECHANICS AND MACHINERY

GROUP III   Marks: 10 x 1 = 10

I)   Braking jet in an impulse turbine is used

   A) to break the jet of water   B) to bring the runner to rest in a short time
   C) to change the direction of the runner   D) to increase the power of the jet

II)   Cavitation is caused by

   A) high velocity   B) low barometric pressure
   C) high pressure   D) low pressure

III)   Non uniform flow occurs when

   A) direction and magnitude of velocity at all points are identical
   B) velocity of fluid particles at any point is same at successive periods of time
   C) magnitude and direction of velocity do not change from point to point in the fluid
   D) velocity, pressure changes from point to point in the fluid

IV)   In parallel pipe problems

   A) energy gradient remains same through all the pipes
   B) head loss is same through all the pipes
   C) total head loss is the sum of individual head loss through each pipe
   D) hydraulic gradient remains same through all the pipes

V)   The flow in a river during the period of heavy rainfall is

   A) unsteady, non-uniform, 2-dimensional   B) steady, uniform, 2-dimensional
   C) unsteady, uniform, 3-dimensional   D) unsteady, non-uniform, 3-dimensional

VI)   Hydraulic grade line for any flow system as compared to energy line is

   A) at same level   B) above   C) below   D) uncertain

VII)   On a standard day a pressure gauge placed below the surface of the ocean (SG = 1.025) reads an absolute pressure of 1.4 MPa. How deep is this instrument?

   A) 129m   B) 4m   C) 133m   D) 140m

VIII)   For a given centrifugal pump

   A) head varies inversely as the speed
   B) the discharge varies directly as the speed
   C) power varies as the square of the speed
   D) discharge varies as the square of the speed

IX)   Which of the following turbine is preferred for 0 to 25m head of water?

   A) Pelton   B) Francis   C) Propeller   D) Kaplan

X)   The velocity gradient in the transverse direction for a fluid flow equals

   A) pressure gradient in the flow   B) strain at a point

   C) stress at a point   D) rate of shear strain